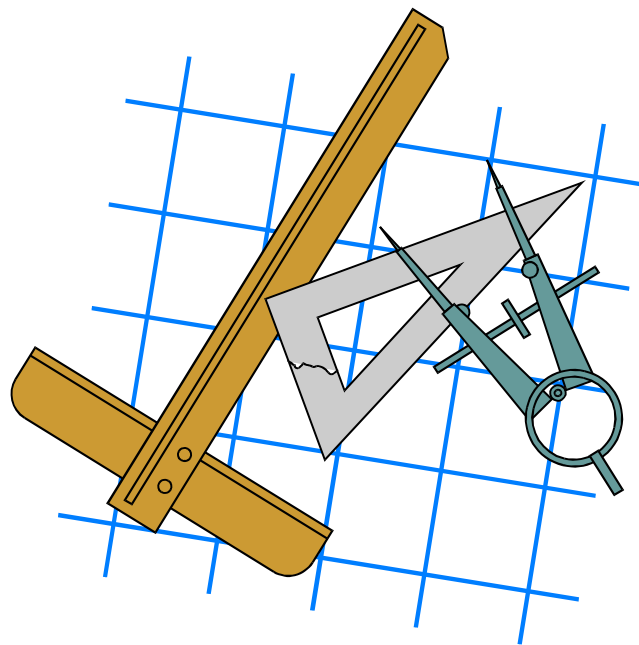


**INSTALLATION AND CLOSURE
OF SHALLOW AQUIFER WELLS AND SOIL BORINGS
ON KELLY AIR FORCE BASE**

**Technical
Design
Specifications**



**Prepared by:
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Acronyms and Abbreviations

AFB	Air Force Base
AST	Aboveground Storage Tank
ASTM	American Society for Testing and Materials
bgs	below ground surface
bls	below land surface
DNAPL	dense non-aqueous phase liquid
EMR	Environmental Management Restoration Division
EPA	Environmental Protection Agency
EPCF	Environmental Process Control Facility
ERPIMS	Environmental Restoration Program Information Management System
ft	feet/foot
ID	inside diameter
in	inch
IRP	Installation Restoration Program
LNAPL	light non-aqueous phase liquid
NGVD	National Geodetic Vertical Datum
NTU	nephelometric turbidity unit
psi	pounds per square inch
PTFE	polytetrafluoroethylene (teflon)
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RPM	Remedial Project Manager
SA-ALC	San Antonio Air Logistics Center
SOW	Statement of Work
TNRCC	Texas Natural Resource Conservation Commission
TSDF	Treatment, Storage or Disposal Facility

PREFACE

This document has been prepared by the Environmental Management Directorate's Restoration Division at Kelly AFB (SA-ALC/EMR), which is responsible for the identification and remediation of sites associated with the Installation Restoration Program (IRP), the Underground Storage Tank (UST) program, the Resource Conservation and Recovery Act (RCRA), and the Environmental Compliance Program (ECP). The purpose of this document *Installation and Closure of Shallow Aquifer Wells and Soil Borings on Kelly Air Force Base – Technical Design Specifications* is to establish minimum standards for all contractors and base employees involved with any aspect of installing or closing shallow wells or soil borings as part of environmental investigations or remediation activities at Kelly Air Force Base. The standards and specifications outlined in this document are based on: (1) specifications outlined in the Kelly AFB Ground Water Compliance Plan (CP-50310); (2) federal and state regulations, specifically the US Environmental Protection Agency (EPA) and the Texas Natural Resource Conservation Commission (TNRCC); (3) recommendations from non-regulatory organizations such as the American Society of Testing and Materials (ASTM) and the National Ground Water Association (NGWA); and (4) past performances of various sampling activities conducted on Kelly AFB.

The term “well” will be used extensively throughout this document. This term will refer to monitoring wells, observation wells, piezometers, temporary wells, pumping wells, extraction wells, recovery wells, or injection wells that are installed in the shallow aquifer beneath Kelly AFB as part of environmental activities. It does not apply to potable water source wells or any other type of well that is not installed as part of environmental activities.

All contractors shall use this document when performing work for Kelly AFB in which shallow aquifer wells or soil borings will be installed, if so directed by the statement of work governing the contract. This document may also be used by other organizations on Kelly AFB involved in construction projects, which may require the installation of monitoring wells and/or the collection of environmental samples. When this document is used by organizations other than Environmental Management, that organization shall be responsible for coordinating all drilling, well installation, sampling and analysis, and data management with the Environmental Management Restoration Division.

1.0 WELL INSTALLATION AND DRILLING SPECIFICATIONS

The following specifications listed in this section shall be complied with during well or soil boring installation or closure activities associated with environmental remedial activities on Kelly AFB. These specifications are intended to supplement state well installation regulations where multiple installation processes are acceptable and to eliminate contradiction between various guidance documents. The objective of these specifications is to create minimum standards for wells installed at Kelly AFB such that they are usable for a period up to 30 years.

The well installation and completion methods specified in this section are designed to meet current federal and state regulations and guidelines for the installation of wells. Specifically, the well design meets requirements of the TNRCC as set forth in 31 TAC 287.41- 287.50, guidelines established by the EPA in the document RCRA Ground-Water Monitoring Technical Enforcement Document, USEPA (OSWER 9950.1), Nov 1986, and ASTM standards printed in Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (D5092-90).

These specifications are not intended to supercede the requirements of regulatory documents including the Kelly AFB Ground Water Compliance Plan (CP-50310). In the event that the specifications outlined in this document do not meet the requirements of regulatory documents, the latter shall take precedence.

1.1 WELL PERMITTING

The contractor shall submit the proposed well location, purpose, and construction details (including screen interval) to the Remedial Project Manager (RPM) approximately 45 days prior to beginning well construction work. The RPM is required to notify the Executive Director of the TNRCC 30 days prior to well installation. Written approval from the Executive Director is required prior to beginning well installation work. This requirement may be met through submittal of a workplan with subsequent approval from the Executive Director. A *Well Design and Construction Specification Checklist* must be completed and submitted to the RPM for each well or series of wells installed at Kelly AFB (see *section 3.8*) documenting adherence to the Kelly AFB Groundwater Compliance Plan well construction specifications.

1.2 WELL CLASSIFICATION

All wells installed on Kelly AFB shall be classified as a monitoring well, observation well, piezometer, temporary well, pumping well, extraction well, recovery well, or injection well. Classification of the well shall be determined based on the primary use of the well as specified in this section. The well classification will be performed by the contractor, but will be coordinated with the RPM.

1.2.1 Monitoring Wells

Monitoring wells shall be used for delineating groundwater contaminant plumes and monitoring movement of these plumes through the collection of groundwater samples for analysis. Monitoring wells shall also be used in obtaining groundwater elevation data. The monitoring well shall be the standard well installed at Kelly AFB and shall be used in all situations in which groundwater samples will be collected. However, in rare circumstances temporary wells may be more suited for the situation (*see section 1.2.4*). The use of any well other than a monitoring well shall be approved by the RPM prior to installation.

1.2.2 Observation Wells

Observation wells shall be used when the primary purpose is to monitor groundwater elevations, and shall be installed near a pumping well, recovery well, or injection well to measure draw downs or injection cones associated with the respective well.

1.2.3 Piezometers

Piezometers shall be used when the primary purpose is to monitor groundwater elevations in areas not associated with pumping wells, recovery wells, or injection wells.

1.2.4 Temporary Wells

Temporary wells shall be used in areas where it is impractical to use a permanent well. Examples of appropriate uses of temporary wells shall include (1) using as a monitoring well to collect groundwater samples from sites that are programmed for imminent remedial action involving excavation or fill of the site, (2) using as a monitoring well to collect groundwater samples over a wide area to isolate a groundwater plume, and (3) using as an observation well to collect groundwater elevation data while conducting

aquifer pump tests. Temporary wells shall be installed using the same general specifications as monitoring wells except as noted in the following provisions.

1. All temporary wells shall be excepted from the specification requiring a concrete pad as a part of the wellhead protection.
2. Upon approval by the RPM, temporary wells used as observation wells during pump tests will be allowed to be completed using schedule 40 PVC sump, screen, and casing in the saturated zone instead of stainless steel sumps, screens and well casing if the well is to be used only for collecting groundwater elevation data and will not be used for collecting groundwater samples for analysis. The PVC screen may also have a schedule 40 PVC end cap placed on the bottom instead of using a sump as stated in the monitoring well specifications.
3. Upon approval by the RPM, a bentonite slurry may be used to fill the annular space of the well instead of the standard cement/ bentonite grout.

1.2.5 Pumping Wells

Pumping wells shall be used when the primary purpose of the well is to pump groundwater out of an aquifer while conducting a pump test. The size of the pumping well shall be determined by the size of the pump to be used in the pump test, which will be dependent on the flow to be extracted during the pump test. Pumping wells shall be installed using the same general specifications as monitoring wells except as noted in the following provisions.

1. The size of the pumping well may exceed 2" if required by the pump test.
2. Upon approval by the RPM, pumping wells 6" in diameter or less will be allowed to be completed using schedule 40 PVC sump, screen, and casing in the saturated zone instead of stainless steel sumps, screens and well casing providing the following conditions are met (1) the well will be used only for pumping groundwater, (2) the well will not be used for collecting groundwater samples for analysis and (3) the chemicals in the groundwater will not destroy the integrity of the PVC materials.

3. Upon approval by the RPM, pumping wells 6" in diameter or greater will be allowed to be completed using steel sumps, screens and well casing in the saturated zone instead of stainless steel sumps, screens and well casing.
4. If the size of the casing exceeds 6" in diameter, the well pad shall be enlarged to allow for a minimum of 24" of pad in all directions from the casing.
5. If the pumping well is planned for eventual use as a recovery well, then the pumping well may be completed below grade in a vault.

1.2.6 Recovery Wells

Recovery wells shall be used when the primary purpose of the well is to extract groundwater for remediation or to recover free product out of an aquifer or soil stratum while remediating groundwater. The size of the recovery well shall be determined by the size of the pump to be used in the recovery system, which will be dependent on the engineered flow to be extracted by the recovery system. Recovery wells shall be installed using the same general specifications as monitoring wells except as noted in the following provisions.

1. The size of the recovery well may exceed 2 inches if required by the design of the recovery system.
2. Upon approval by the RPM, recovery wells 6 inches in diameter or less will be allowed to be completed using schedule 40 PVC sump and casing in the saturated zone instead of stainless steel sumps and well casing providing the following conditions are met (1) the well will be used only for pumping groundwater and/or product, (2) the well will not be used for collecting groundwater samples for analysis and (3) the chemicals in the groundwater will not destroy the integrity of the PVC materials.
3. Upon approval by the RPM, pumping wells 6 inches in diameter or greater will be allowed to be completed using steel sumps, screens and well casing in the saturated zone instead of stainless steel sumps, screens and well casing.
4. Recovery wells will be completed below grade in a vault so that all associated piping can be connected to the well below grade. The design of the vault will be detailed during the remedial design phase of the remedial activities.

1.2.7 Injection Wells

Injection wells shall be used when the primary purpose of the well is to inject groundwater or nutrients to aid in the remediation of groundwater. The size of the injection well will be dependent on the engineered flow to be injected by the system. Injection wells shall be installed using the same general specifications as monitoring wells except as noted in the following provisions.

1. The size of the injection well may exceed 2 inches if required by the design of the injection system.
2. Upon approval by the RPM, injection wells used in injection systems will be allowed to be completed using schedule 40 PVC sump, screen, and casing in the saturated zone instead of stainless steel sumps, screens and well casing if the substance to be injected will not affect the integrity of PVC material and will not be used for collecting groundwater samples for analysis.

1.2.8 Extraction Wells

Extraction wells shall be used when the primary purpose of the well is to extract air from the vadose zone of contaminated soil to remediate or aid in remediation of the soil. The size of the extraction well will be dependent on the engineered flow to be removed by the extraction system. Extraction wells shall be installed using the same general specifications as monitoring wells except as noted in the following provisions.

1. The size of the extraction well may exceed 2 inches if required by the design of the extraction system.
2. Upon approval by the RPM, extraction wells used in extraction systems may be completed using schedule 40 PVC sump, screen, and casing if the substance being extracted will not affect the integrity of PVC material.

1.3 DRILLING METHOD SPECIFICATIONS

Soil borings designed for soil sample collection or well installation shall be completed using the specifications identified in paragraphs 1.3.1 through 1.3.8.

1.3.1 Drilling Oversight

A qualified geologist or geotechnical engineer shall supervise all drilling activities. The geologist/ engineer shall document all drilling activities as specified in section 3.0.

1.3.2 Air Monitoring

The geologist or engineer shall periodically monitor the air from the soil boring for potentially hazardous or toxic organic vapors or gasses using a calibrated vapor emission detector (photo-ionization detector or organic vapor analyzer) during all drilling operations. The vapor emission readings shall be included on the log sheet.

1.3.3 Drilling Methods

The contractor shall use well drilling methods that minimize potential adverse effects on the quality of water samples withdrawn from the well, and that minimize or eliminate the introduction of foreign fluids into the borehole.

1.3.4 Drilling Fluids

Water added as a drilling fluid shall not contain bacteriological or chemical constituents that could interfere with the formation or with the chemical constituents being monitored. For ground-water recovery and injection wells, drilling fluids containing freshwater and treatment agents may be utilized in accordance with standard engineering practice to facilitate proper well installation. In these cases, the water and agents added should be chemically analyzed to evaluate their potential impact on in-situ water quality and to assess the potential for formation damage. All such additives shall be removed to the extent practicable during well development.

1.3.5 Augers – Soil Borings

All borings completed for the sole purpose of collecting soil samples shall be drilled using hollow stem, continuous flight drilling systems.

1.3.6 Augers - Wells

For wells with a casing diameter 6 inches or less, the soil boring shall be drilled using hollow stem, continuous flight drilling systems. The size of the boring shall be sufficient to give a minimum of 2 inches annular space between the outside of the well casing and the borehole. For wells that will have a casing diameter greater than 6 inches, the soil

boring may be completed using an appropriate drilling technique for the well that is to be installed. Suggested techniques include pier rig and cable tool rig.

1.3.7 Borings Completed In The Navarro

All borings shall be completed so that they extend 1 foot but not more than 5 feet into the Navarro Clay formation, which is the lower confining aquitard for the alluvial aquifer under Kelly AFB. Exceptions to this requirement shall be made in cases where the well is being installed as a part of a well cluster in which at least one well of the cluster is already completed into the Navarro Clay formation, and when the hydrologic unit to be screened is a perched aquifer that is located above the alluvial aquifer or is a silt seam within the Navarro Clay.

1.3.8 Borings Not Completed In The Navarro

If the boring is not completed into the Navarro Clay formation, it shall either be completed into a zone of lesser permeability than the hydrologic unit being screened or shall have a sodium bentonite plug placed at the bottom of the boring. The sodium bentonite plug shall be 1 foot thicker than the length of the sump that will be used in the well construction. All modifications of the standard boring specifications shall be approved by the RPM prior to beginning the boring and well installation.

1.4 GENERAL WELL INSTALLATION SPECIFICATIONS

All wells shall be constructed such that they can be routinely sampled with a pump, bailer or alternate sampling device. Piping associated with recovery wells should be fitted with sample ports or an acceptable alternative sampling method to facilitate sampling of the recovered groundwater on a well by well basis. Wells shall be installed in accordance with all applicable state regulations pertaining to well installation as amended in paragraphs 1.4.1 through 1.4.8.

1.4.1 Installation Oversight

A qualified geologist or geotechnical engineer shall supervise all well installation activities. The geologist/ engineer shall document all well installation activities as specified in section 3.0.

1.4.2 Sump

A sump shall be installed at the bottom of the well screen to catch sediment trapped within the well casing. The sump shall not exceed 1 foot in length. Sumps exceeding 1 foot in length may be utilized to accommodate ancillary equipment. If possible, the length of the sump should be sufficient to allow the well to be completed into a zone of lesser permeability while keeping the well screen at the bottom of the aquifer to be tested. The bottom of the well shall be plugged with a polytetrafluoroethylene (PTFE), stainless steel or an approved alternate material. The TNRCC must approve the alternate material prior to use in well construction.

1.4.3 Screen

The bottom of the well screen shall be set not more than 6 inches above or below the bottom of the aquifer to be evaluated. The well screen shall extend at least 2 feet but not more than 5 feet above the water surface of the aquifer, up to a total screen length of 10 feet. The screen length shall not exceed 10 feet within a given transmissive zone unless otherwise approved by the Executive Director. Whenever possible, the well screen shall screen the entire transmissive zone. Screen lengths exceeding 10 feet may be installed in ground-water recovery or injection wells to optimize the ground-water remediation process in accordance with standard engineering practice. Each well shall screen only one aquifer. If another aquifer is encountered prior to reaching the aquifer to be tested, provisions shall be taken to ensure that the waters of the two aquifers do not interchange. The height of a well screen above a water table and a filter pack above a well screen may be modified after approval by the RPM in instances where the possibility exists that waters of two different aquifers will commingle due to close proximity. For light non-aqueous phase liquid (LNAPL) sites, the well screen must cover an adequate interval in the vadose zone to allow for water table fluctuation. For dense non-aqueous phase liquid (DNAPL) sites, the well screen must extend from the top of the lower confining zone to above the top of the DNAPL saturated zone. Well clustering shall be utilized when a total screen length in excess of 10 feet is required. See section 1.5 for material specifications.

1.4.4 Filter Pack

A filter pack shall be installed in the annular space between the well casing and the borehole over the complete distance of the screen and shall continue for a height of at

least 2 feet but not more than 3 feet above the top of the screen. See section 1.5 for material specifications.

1.4.5 Seal

A sodium bentonite annular seal shall be installed above the top of the filter pack. The thickness of the seal shall be at least 2 feet but not more than 3 feet. See section 1.5 for material specifications.

1.4.6 Grout

A cement/sodium bentonite grout shall be placed in the annular space from the top of the annular seal to the bottom of the well pad. The grout shall be placed in the annular space by means of a tremie pipe or pressure grouting methods equivalent to tremie grouting standards up to 2 feet below ground surface (bgs). The remainder of the borehole shall be filled with concrete during the pad construction. See section 1.5 for material specifications.

1.4.7 Wellhead Protection

A sloping, steel reinforced concrete pad measuring 4.5 feet x 4.5 feet x 4 inches shall be constructed on top of the borehole to protect the well from surface water and runoff. The edge of the concrete pad should extend at least 2 feet from the outer edge of the well casing material. See section 1.5 for material and construction specifications. See Figures 1 through 7 (Appendix A) for design plans. If the well site is covered with concrete or asphalt prior to well installation, the concrete or asphalt shall be sawn and removed prior to completing the concrete pad. The size of the cut shall be the same size as the pad and shall act as the form or part of the form for the pad.

1.4.8 Special Circumstances

Special provisions will be allowed for wells completed in areas where there is not sufficient depth to the groundwater to accommodate the specifications listed in paragraphs 1.4.1 through 1.4.7. An example of such areas would be wells completed in the vicinity of Leon Creek, where total depth to the groundwater may only be 3 feet. In these situations, the RPM shall be notified immediately and the specifications will be modified for that well location. The well shall be installed using best engineering judgment.

1.5 WELL CONSTRUCTION MATERIAL SPECIFICATIONS

1.5.1 Well Casings And Screens

The standard well casing that will be used on Kelly AFB shall be constructed using a stainless steel sump, a stainless steel machine-slotted or continuous wrapped wire-wound well screen, a stainless steel riser in the saturated zone, and a schedule 40 PVC riser in the vadose zone. The PVC casing must bear the National Sanitation Foundation logo for potable water applications (NSF-pw). If approved by the RPM, schedule 40 PVC may be substituted for stainless steel for sumps and risers in the saturated zone. This approval will be granted prior to the installation of the well. All joints on the sump, well screen, and riser shall be threaded. Square profile flush joint threads are preferred over tapered thread joints; however, tapered thread joints shall be acceptable if all joints are wrapped with PTFE tape to prevent leakage at the joints. Glued or solvent welded joints shall not be allowed. All casing material (including sump, screen, and riser) shall be new and clean to ensure that the interior and exterior protective coatings have been removed. The casing and screen material shall be steam cleaned or detergent cleaned (*if constructed of fluorocarbon resins*) prior to installation.

The diameter of the casing is dependent on the type of well being installed. Monitoring wells, observation wells and piezometers shall be constructed of 2 inch inside diameter (ID) casing material, and extraction, pumping, injection, and recovery wells shall be constructed of 2 inch ID, 4 inch ID or 6 inch ID casing material. The size of extraction, pumping, and recovery wells shall be determined during the engineering evaluation and design of the pumping, extraction, injection, or recovery system. The size of the screen opening will be dependent on the size and gradation of the filter pack. Acceptable screen sizes are shown in Table 1 for different filter pack mesh sizes. The standard screen to be used at Kelly AFB shall be number 10 slot with a 20 to 40 mesh size sand pack. Other screen sizes shall be used if hydrologic conditions warrant the use of a different mesh size sand pack and is approved by the RPM. The sump shall not exceed 1 foot in length except to accommodate ancillary equipment.

TABLE 1 Screen Opening Sizes for Sand Pack Mesh Sizes

Size of Screen Opening (in.)	Slot Number	Sand Pack Mesh Size
0.005	5	100
0.010	10	20 to 40
0.020	20	10 to 20
0.030	30	10 to 20
0.040	40	8 to 12
0.060	60	6 to 9
0.080	80	4 to 8

1.5.2 Filter Pack

The primary filter pack shall be constructed with washed and screened silica sand or gravel of a known chemistry and selected grain size and gradation. The filter pack will have a 30% finer (d-30) grain size that is 4 to 10 times greater than the d-30 of the hydrologic unit being filtered. Use a multiplier of 4 to 6 for fine and uniform stratum and a multiplier of 6 to 10 if the stratum is non-uniform and contains silts. The uniformity coefficient (d-60/d-10) of the filter pack shall range between 1.0 and 2.5, preferably as close to 1.0 as possible. Filter packs having a uniformity coefficient exceeding 2.5 shall not be used. Standard filter pack material for wells at Kelly AFB shall be washed and screened silica sand with a mesh size of 20 to 40 with a uniformity coefficient of 1.3 - 1.7. The sand pack is required to be coarser than surrounding strata to ensure LNAPL movement into the well bore. Other filter packs may be used if hydrologic conditions warrant and approval is received from the RPM.

1.5.3 Annular Seal

Bentonite shall be used to seal the annulus above the filter pack. A minimum of 2 feet of pellet or granular bentonite shall immediately overlie the filter pack in the annular space between the well casing and borehole. Where the saturated zone extends above the filter pack, pellet or granular bentonite shall be used to seal the annulus. The bentonite shall be allowed to settle and hydrate for a sufficient amount of time prior to placement of grout in the annular space. Bentonite pellets and chips must be small enough to prevent bridging. All pellets or chips shall be no larger than 1/5 the size of the annulus to be sealed. For a 3-inch annular space the maximum pellet or chip size shall be 1/2

inch and for a 2-inch annular space the maximum pellet or chip size shall be 3/8 inch. The bentonite shall be free of all impurities, which could adversely affect the chemistry of the water being sampled.

1.5.4 Grout

A cement/sodium bentonite grout shall be placed in the annular space between the top of the bentonite annular seal and to within 2 feet of the surface. A suitable amount of time shall be allowed for settling to occur. The grout shall be made by adding and mixing between 6% to 10% (by dry weight) sodium bentonite powder to dry Type I Portland cement. Water shall then be added to the cement/sodium bentonite powder and mixed with a paddle type mechanical mixer or by recirculating the mix through a pump until all lumps are disintegrated. The water-cement ratio of the mixture shall not exceed 0.6. No additives, plasticizers, or air shall be added to the grout. An example recipe for the cement/sodium bentonite grout is listed below, which will have 6% by dry weight of sodium bentonite.

- 1 - 94 pound bag of Type I Portland cement
- 6 pounds of powdered sodium bentonite
- 7 gallons of potable water

Other grouts may be used if approved by the Executive Director.

1.5.5 Wellhead Protection

The wellhead shall be protected from infiltration of surface water by using a steel reinforced concrete pad. The standard pad to be used at Kelly AFB shall be a flush mounted pad; however, a surface mounted pad may be used if so directed by the RPM. Surface mounted pads shall be used if the well is installed in a depression or an area subject to ponding. Material specifications for pad construction are detailed in Tables 2 and 3.

1.5.5.1 Flush Mounted Pad.

The size of the pad shall be 4 inches thick and extend 2 feet beyond the outside of the casing (square-shaped). The annular space above the sodium bentonite seal shall be filled with concrete and blended with the pad. The flush mounted pad shall be 2 inches

above the ground surface at the center and shall slope 2 inches from the center to the edge so that the edge of the pad is level with the ground surface. The pad shall be recessed 4 inches into the ground at the edges. The pad shall be reinforced with No. 4 Grade 50 steel reinforcing bars as shown in Figure 5 of Appendix A. A manhole shall be placed in the center of the pad, and the well shall be completed inside the vault of the manhole. The top of the well casing shall be 3 inches ($\pm \frac{1}{2}$ inch) bgs, which will put the casing at 5 inches ($\pm \frac{1}{2}$ inch) below the top of the manhole. The top of the well casing shall be 4 inches ($\pm \frac{1}{2}$ inch) from the bottom of the vault. The well casing shall be wrapped with plastic or mastic where concrete will be poured to prevent the pad from bonding to the casing. A lockable security plug with lock shall be installed on the well casing after the well is completed to protect the well. Design plans for flush mounted pads are shown in Figures 1, 2, 5, and 6 of Appendix A.

TABLE 2 Material Specifications – Flush Mount Pad Construction

MATERIAL	SPECIFICATIONS
Concrete	3000 psi, $\frac{3}{4}$ in maximum size aggregate, 4 in – 6 in slump.
Steel Reinforcement Bars	Number 4, Grade 50.
Manhole	2 in ID wells require a 8 in cast iron manhole with a 18 in, 18-guage steel collar. 4 in ID and 6 in ID wells require a 12 in cast iron manhole with a 18 in, 18 gauge steel collar. Manhole must have a rubber gasket between cover and vault. Manhole cover must be imprinted with “Test – Observation – Monitoring Well” and “No Fill” or similar wording.
Lockable Security Plug, With Lock	Lockable flush installation security plug, compresses by tightening wing nut, ABS or similar main body, brass wing nut and bolt, high visibility color, must be imprinted with “Test Well” and “No Fill” or similar wording (Morrison or equal).
Lock	Master lock keyed to fit key #3446, size: #2 as appropriate for well, material: brass lock with steel shank.

1.5.5.2 Surface Mounted Pads.

The pad shall be 4 inches thick and extend 2 feet beyond the outside of the casing (square-shaped). The annular space above the sodium bentonite seal shall be filled with

concrete and blended with the pad. The surface mounted pad shall be 6 inches above the ground surface at the center and shall slope 2 inches from the center to the edge so that the edge of the pad will be 4 inches above the ground surface. The pad shall be reinforced with No. 4 Grade 50 steel reinforcing bars as shown in the foundation plan. See Figure 5 of Appendix A. The well casing shall be wrapped with plastic or mastic where concrete will be poured to prevent the pad from bonding to the casing. The well casing will extend 3 feet above the top of the pad, and shall be protected with a steel sleeve. The steel sleeve shall have a minimum wall thickness of 3/16 inch, and shall have a diameter 4 inches greater than the well casing. The sleeve shall extend 3 inches above the well casing and shall be completed with a locking, weatherproof protective cap with a lock for protection. The well casing shall have a lockable security plug without a lock installed after the well is completed for additional protection from debris. The sleeve shall extend 6 inches below the surface of the concrete pad. The sleeve shall also have a drilled and tapped hole no higher than 1 inch from the top of the pad that will accept a 3/8 inch diameter coarse thread bolt for drainage of the protective casing. The hole shall be plugged with a 3/4 inch long, 3/8-inch diameter, coarse thread, hex-head bolt. Surface mounted pads shall have four guard posts installed 18 inches from each corner of the pad. The guard post shall be a 4 inch diameter steel pipe. The guard post shall be completely filled with concrete, and the concrete shall be mounded on the top of the guardian post to facilitate water drainage. The guard post shall extend 3 feet above the ground surface and shall extend 12 inches into a concrete footing. The concrete footing shall be 12 inches in diameter and 18 inches deep. Design plans for surface pads are shown in Figures 3, 4, 5, and 6 of Appendix A.

TABLE 3 Material Specifications – Surface Mount Pad Construction

MATERIAL	SPECIFICATIONS
Concrete	3000 psi, ¾ in maximum size aggregate, 4 in – 6 in slump.
Steel Reinforcement Bars	Number 4, Grade 50.

**TABLE 3 Material Specifications – Surface Mount Pad Construction
(Continued)**

MATERIAL	SPECIFICATIONS
Lockable Security Plug, Without Lock	Lockable flush installation security plug, compresses by tightening wing nut, ABS or similar main body, brass wing nut and bolt, high visibility color, must be imprinted with "Test Well" and "No Fill" or similar wording (Morrison or equal).
Steel Casing	Wall of casing shall have a minimum thickness or 3/16 in, diameter of casing shall be 4 in greater than diameter of PVC riser.
Lockable Protective Cap, With Lock	Metal, weatherproof.
Lock	Master lock keyed to fit key #3446, size: #2 as appropriate for well, material: brass lock with steel shank.

1.6 WELL COMPLETION

1.6.1 Well Development

After installation, the well shall be developed to remove finer grained material that may interfere with water quality analysis and to stabilize the filter pack. Acceptable well development methods shall include mechanical surging and bailing or pumping and over pumping. Development shall be continued until representative water, free of drill cuttings or any other material introduced during well construction, is obtained. Representative water is assumed to be obtained when pH, specific conductivity, temperature, and pH have stabilized and the water is free of suspended solids (*EPA recommends less than 5 NTU turbidity*). The stabilization criteria that shall be used are (1) specific conductance within 10% of previous reading, (2) temperature within 1°C of previous reading, and (3) pH within 10% of previous reading.

1.6.2 Survey

All wells shall be surveyed after installation is completed. The survey shall include determining horizontal and vertical location of the well, and the vertical location of the well casing and water table. The horizontal location shall include northing and easting coordinates referenced to existing horizontal control markers established for Kelly AFB and shall be determined to the nearest hundredth of a foot (0.01 feet). Vertical elevations shall be determined for a survey marker located on the well pad and a

permanent referenced mark on the well casing which shall be the bottom of a V-notch cut into the riser. The notch shall be 1/8 inch wide at the top and 1/8 inch deep at the bottom. Vertical elevations will be referenced to the National Geodetic Vertical Datum, and shall be determined to the nearest hundredth of a foot (0.01 feet). Water levels in wells shall be measured to the nearest hundredth of a foot using an electrical water level meter, stainless steel popper, or tape and chalk or paste. Depths shall be measured from a permanent surveyed reference point on the top of the well casing to provide accurate water elevations. The measuring device shall be decontaminated between measurements.

1.6.3 Well Labeling

A brass plate measuring 3 inch x 5 inch x 1/8 inch thick shall be permanently attached to the well pad for well identification information within 30 days of well pad completion. This information shall be stamped or embossed into the plate, and shall include well number, northing coordinate, easting coordinate, pad elevation, casing elevation, the date the well was installed, and the name of the company installing the well. The well number will be supplied by the RPM. The size of letters and numbers on the plate shall be 3/16 inch with 3/16 inch spacing between rows. See Figure 7 of Appendix A for detail drawing. The top surface of the brass plate shall be flush with the surface of the concrete pad. This shall be accomplished by creating a 1/4-inch deep indentation in the concrete pad when the concrete is poured using a 3-inch segment of a 1 x 5 board. **A temporary well ID tag shall be attached to the well cap upon installation of the well cap.** The temporary tag shall be constructed of light metal approximately 2 inches in diameter and shall be stamped or embossed with the well ID number assigned by the RPM. The temporary tag will serve as identification purpose until the permanent brass ID plate is installed.

1.6.4 Performance Standards

Wells are to be installed so that groundwater samples, representative of aquifer conditions, can be collected. Also, well construction is required to minimize potential adverse effects on quality of water samples and to minimize or eliminate introduction of foreign fluids into the borehole.

1.6.4.1 Monitoring Wells, Observation Wells and Piezometers.

All 2 inch monitoring wells, observation wells, temporary wells and piezometers shall be installed in a manner so that a rigid 96 inch long, 1½ inch diameter dummy can be lowered the complete distance of the well without binding.

1.6.4.2. Recovery and Extraction Wells.

All pumping wells, recovery wells, extraction wells and injection wells shall be installed so that the equipment they were designed for is capable of being placed in the well at the designed depth without binding and is capable of meeting manufacturer's operating specifications.

1.6.4.3 Well Replacement

If a well has deteriorated due to incompatibility of casing and contaminants, the well shall be replaced within 90 days of the date the deterioration was identified. If Kelly AFB or the Executive Director determines that the well integrity or materials of construction, or well placement no longer enable the well to produce samples representative of groundwater quality, the well shall be replaced. Replacement of point of compliance and background wells shall occur within 15 feet of the original location. If this distance requirement cannot be met, the contractor shall notify the RPM of the alternate location, who then in turn must obtain approval from the Executive Director.

1.7 WELL AND SOIL BORING ABANDONMENT

Wells and borings shall be abandoned in such a manner that the boring or well will not act as a conduit for surface contamination to travel down to groundwater that may be present at the well or boring location. Wells shall be abandoned using the specifications identified in paragraphs 1.7.1 through 1.7.6 below, while soil borings shall be abandoned using paragraphs 1.7.5 and 1.7.6 only.

1.7.1 Salvageable Materials

All salvageable materials, such as locks, security plugs, manhole covers and weatherproof caps shall be removed and delivered to the RPM.

1.7.2 Well Pad

The removal of the concrete pad precedes the extraction of all removable casing and well screen. If the whole casing and screen cannot be successfully removed, it should be cut off as far below grade as possible.

1.7.3 Well Casing and Screen

All removable casing shall be removed from the well.

1.7.4 Redrilling

The well shall be redrilled to the same diameter and depth of the original borehole of the well. This will ensure sufficient opening in the borehole for grouting.

1.7.5 Grout

The new boring shall be filled with a cement/sodium bentonite grout to within 6 inches but not closer than 4 inches of the ground surface, with the following exception. If the well location was covered with asphalt or concrete, the grout shall not be placed higher than the bottom of the original base material if base material is present in the surrounding area or the bottom of the asphalt or concrete if base material is not present. Soil shall not be placed in the borehole. Soil borings, which did not penetrate an aquifer, may be abandoned using bentonite chips or granules instead of the cement/ sodium bentonite grout if approved by the RPM.

1.7.6 Surface Preparation

The surface of the well site (*including the upper 4-6 inches of the borehole*) shall be completed to match the surface of the surrounding area. Details of surface completions are specified in Table 4.

TABLE 4 Surface Completion of Abandoned Well Sites

EXISTING COVER OF SURROUNDING AREA	TASKS REQUIRED TO REMEDIATE SURFACE OF WELL SITE
Grass	Place soil up to existing grade. Tamp or compact soil as it is added to prevent excessive settling. Seed soil with grass of similar type to the surrounding area.
Gravel	Place soil up to the level of soil in surrounding area. Cover with gravel of similar size and type up to the existing grade.
Asphalt	Add and compact base material up to level of existing base material, if present. Gradation of base material and amount of compaction should be equivalent to existing base. Add asphalt on top of base material (<i>if base material was required</i>) and bring up to existing grade. Compact as required to meet specifications of the surrounding asphalt. New asphalt shall be similar to surrounding asphalt.
Concrete	Add and compact base material up to level of existing base material, if present. Gradation of base material and amount of compaction should be equivalent to existing base. Drill holes in side of existing concrete and place reinforcing steel in holes to bond old slab and new slab together. The size and grade of the reinforcing steel and distance steel must penetrate into existing slab shall meet ACI specifications. Place reinforcing steel in area of well pad, tie into steel placed into existing slab. Add concrete on top of base material (<i>if base material was required</i>) and bring up to existing grade. Finish poured concrete to match surrounding finish. New concrete and reinforcing steel shall meet specifications of surrounding concrete and reinforcing steel.

1.8 EQUIPMENT DECONTAMINATION

Large equipment, such as drill rigs and augers, shall be decontaminated between each use by thoroughly spraying the equipment with high-pressure steam cleaner on a wash rack designated by the RPM. A government contractor manages the wash rack and corresponding use shall be coordinated with the contractor and the RPM. Small non-expendable equipment, such as split spoon samplers and split barrel samplers, shall be

decontaminated between each use in an on-site decon pad using the procedure listed below.

1. Thoroughly wash the equipment in normal tap water using nonphosphate detergent.
2. Rinse with tap water to remove all soap.
3. Rinse with a light spray of methanol.
4. Rinse with a light spray of pesticide grade hexane.
5. Rinse with a light spray of methanol again.
6. Rinse with distilled or deionized water.
7. Allow to thoroughly air dry.

1.8.1 Steam Cleaner

The contractor shall supply the steam cleaner. If electricity is available at the wash rack, the contractor may use that electrical supply to operate an electric steam cleaner. Otherwise, the contractor shall use either a gas-powered steam cleaner, or supply a gas-powered generator to power an electric steam cleaner.

1.8.2 Decon Pad

The contractor shall be responsible for building, maintaining and removing the on-site decon pad for the small equipment.

1.8.3 Decon Fluid Accumulation

At the end of each day, the contractor shall remove the decon fluids from the decon pad and place in a steel drum. This drum will only contain decon fluids and will not be mixed with Investigative Derived Waste (IDW) or any other material. This drum will be treated as a satellite accumulation point until the drum is full or the drilling operation is complete, which ever comes first.

2.0 WASTE MANAGEMENT

2.1 INVESTIGATIVE DERIVED WASTE (IDW)

All soil and drill cuttings, development water and purge water generated by field activities will be called IDW at the time of generation. Initially, all IDW will be handled and treated as RCRA hazardous waste until the contractor can properly characterize the waste through analysis and determine the proper waste classification. Once the IDW is classified, the contractor shall be responsible for handling the different classifications of IDW as listed in sections 2.2 through 2.6.

2.1.1 Containers

Since it is possible that the IDW can be classified as hazardous waste, the contractor shall place all IDW in containers which will meet U. S. Department of Transportation (DOT) specifications (49 CFR 171-179) for hazardous waste.

2.1.2 IDW Container Labeling/Tracking

The Environmental Management Restoration Division (EMR) at Kelly AFB has instituted a program designed to track all containers of environmental material generated during closure or remedial investigations on or for Kelly AFB. All containers generated for such projects which contain environmental materials, including decontamination water, purge water, development water, and drill cuttings, shall be labeled with a **"Restoration Waste"** label (see Appendix B1). The **"Restoration Waste"** label will include the following information:

1. Contents of the container
2. Control Number (furnished by the RPM)
3. EM Point of Contact (RPM)
4. Name of the primary contractor and phone number
5. Name of the drilling subcontractor
6. IRP Zone and Site number
7. Soil boring or well number(s)
8. Sample numbers corresponding to the contents
9. Contract number

The following items apply to IDW labeling:

1. The labels will be provided to the contractor on an as-needed basis by the RPM. Environmental Management controls the issuance and use of the labels.
2. The contractor shall complete all spaces on the IDW label that were left blank when issued by Environmental Management. All information on the label shall be printed legibly using a medium point (or heavier) black permanent marker or paint stick. Use of fine point or ultra fine point markers will not be allowed, as these tend to fade very quickly when left outdoors.
3. The contractor shall affix the label to the container prior to filling the container. The label shall be affixed directly to the side of the drum near the top. The area of the drum where the label is to be affixed shall be thoroughly cleaned prior to affixing the label.
4. The control number shall be marked on the side and top of the drums using a paint stick of contrasting color. The control number shall be legible, and the numbers shall be at least 2 inches in height.
5. The contractor shall not place any item(s) into the containers bearing these labels other than as listed on the issued label.
6. The contractor shall return all unused labels to the RPM upon completion of the field activities.
7. The contractor shall submit a written record on a weekly basis to the RPM during all field activities, which generate environmental material requiring the IDW labels.
8. The written record shall be a list of all label control numbers issued since the previous record, the date the labels were issued, the container contents, the soil boring or well numbers, the sample numbers, the date the container was filled, the location of the container, and the date the container was moved into the staging area.
9. The contractor shall include a map of the staging area(s) depicting the location of all labeled containers in relation to each other and the corresponding control number.
10. The contractor shall notify the RPM of the need for additional labels at least one working day before the labels are needed.

After the waste classification of each container has been determined, the contractor shall mark and label each container of soil in accordance with the Kelly AFB Hazardous Waste Management Plan which incorporates federal and state regulations pertaining to hazardous and industrial solid waste.

2.1.3 Accumulation

The contractor shall place all soil and drill cuttings from each soil boring or monitoring well into containers, close the containers, clean the containers, and mark and label the containers for identification purposes before proceeding to the next boring or well location. See section 2.1.2 for labeling requirements. Purge water and development water can be mixed from one well to another, if needed.

2.1.4 Personal Protective/Sampling Equipment

Personal protective equipment and disposable sampling equipment shall be placed in separate containers, and shall not be mixed with drill cuttings, development water or purge water. See section 2.7.

2.1.5 Non-Environmental Waste

General refuse and manmade materials such as asphalt and concrete shall not be placed in containers accumulating IDW.

2.1.6 Waste Characterization

The contractor shall analyze and characterize the soil and drill cuttings in accordance with applicable federal and state regulations in order to determine the waste classification of the soil.

2.1.7 Container Storage

The contractor shall transport the containerized cuttings to an on-site staging area designated by the RPM pending the return of analytical results and waste classification. The IDW containers will be stored in accordance with the following specifications.

1. The contractor shall store all drums on a level site that is not within the 100-year flood plain (applicable to on-site storage only).

2. The contractor shall place all IDW containers on either wooden or plastic pallets to elevate the container off the ground. Steel drums shall be placed on pallets in the upright position.
3. The contractor shall place no more than three (3) 55-gallon steel drums per pallet.
4. The drums shall be placed on the pallet in such a manner that all of the labels and control numbers are plainly visible.
5. Pallets shall be staged end to end such that they form a single line of pallets. This will ensure that all containers are readily accessible.
6. Each row of pallets shall be separated with sufficient distance to allow drum handling vehicles (forklift or trucks with trailers) to travel and operate between each row of pallets.

These storage procedures shall be used when the drums are stored on-site and when they are in an accumulation site.

2.2 HAZARDOUS WASTE AND TNRC CLASS 1 INDUSTRIAL SOLID WASTE

Upon determination that a container or containers of IDW contain RCRA hazardous or class 1 industrial solid waste, the contractor shall meet the requirements in paragraphs 2.2.1 through 2.2.4.

2.2.1 Container Labeling

Contractor shall replace the “**Restoration Waste**” label with a “**Hazardous Waste**” label for hazardous waste or a “**Non-Hazardous Waste**” label for class 1 nonhazardous waste. Labels shall be obtained from Environmental Management Waste Section and shall comply with the Kelly AFB Hazardous Waste Management Plan.

2.2.2 Container Storage

The contractor shall move the containers from the on-site staging area to a 90-day accumulation site maintained by Environmental Management. These containers shall be moved to an accumulation site within three days of which the IDW is determined to be a hazardous or class 1 industrial solid waste. The waste containers will remain at that

staging facility until transportation to a TSDF. The contractor shall be responsible for the condition of the containers of waste up to the point it is received for shipment by the transporter. If the contractor placed the waste in a container that was not DOT approved, or was not in condition suitable for transportation, the contractor shall be responsible for transferring the waste into a new container or overpack.

2.2.3 Waste Analysis

The contractor shall provide the RPM all analytical results used to classify the IDW as hazardous or class 1 industrial solid waste. Waste classification shall be done in accordance with the Kelly AFB Hazardous Waste Management Plan.

2.2.4 Waste Disposal

The Environmental Management Directorate will be responsible for ensuring the hazardous or class 1 industrial solid waste is transported to a TSDF for disposal. Upon receipt of the return copy of the manifest documents from the TSDF, the contractor will be released from further responsibility of the waste.

2.3 TNRCC CLASS 2 INDUSTRIAL SOLID WASTE

The contractor is responsible for disposing of containerized materials determined to be TNRCC class 2 industrial solid waste and municipal solid waste. In order for solid waste to be classified as class 2, analytical requirements must be met in accordance with the Kelly AFB Hazardous Waste Management Plan and 30 Texas Administrative Code Subchapter R (335.506). The contractor shall dispose, or make arrangements for disposal, of all soil determined to be TNRCC class 2 industrial solid waste or municipal solid waste, at an appropriate off-base landfill. The contractor shall adhere to the requirements of the Kelly AFB Hazardous Waste Management Plan pertaining to waste disposal. Once it has been determined that IDW is class 2 nonhazardous waste, the “**Restoration Waste**” label shall be replaced with a “**Non-Hazardous Waste**” label in accordance with the Kelly AFB Hazardous Waste Management Plan. The relabeling shall be coordinated with the Environmental Management Waste Section.

2.4 TNRCC CLASS 3 INDUSTRIAL SOLID WASTE AND CLEAN SOIL

The contractor shall dispose of TNRCC Class 3 industrial solid waste or clean soil at a location on-base designated by the RPM. Clean soil is defined as soil that does not have any contamination or man-made material (i.e., concrete, asphalt, or general refuse) present. In order for solid waste to be classified as Class 3, rigorous analytical requirements must be met in accordance with the Kelly AFB Hazardous Waste Management Plan and 30 Texas Administrative Code Subchapter R (335.507). The contractor shall be responsible for transporting the Class 3 and/or clean soil from the staging area to the disposal site, removing the soil from the containers, grading the soil over the fill area, and delivering the empty containers to Bldg. 317 for proper disposal. Upon determination that IDW is class 3 nonhazardous waste and prior to disposal, the **"Restoration Waste"** label shall be replaced with a **"Non-Hazardous Waste"** label in accordance with the Kelly AFB Hazardous Waste Management Plan. The relabeling shall be coordinated with the Environmental Management Waste Section.

2.5 DEVELOPMENT AND PURGE WATER

Water generated as a result of field activities shall be collected, analyzed, and temporarily stored until a schedule can be worked out with the Environmental Process Control Facility (EPCF) to allow discharge at a rate which will not violate the EPCF's permit. The contractor shall containerize the water generated as a result of well development or well purging in containers supplied by the contractor. The contractor shall transport the containers to a staging area designated by the RPM pending the return of analytical results. After the results of the chemical analyses are returned, a schedule will be established by the RPM and the EPCF Plant Manager for discharge of the water into the EPCF. The contractor shall transport the containers of water from the staging area to the EPCF and shall discharge the water into the EPCF as directed by the RPM and EPCF Plant Manager. Water generated as a result of a pump test shall be pumped into tanks provided by the EPCF. These tanks will be delivered to the site and will be picked up from the site and taken to the EPCF by Kelly AFB personnel. **Note: The portable tanks available through the EPCF have a capacity of 1,000 gallons. For large pump tests, the contractor may be required to make other**

arrangements for accumulation and delivery of water to the EPCF. This shall be coordinated in advance with the RPM.

2.6 DECON FLUIDS

This section is applicable only in cases where the contractor elects to use their own portable decontamination pad. This section does not apply to the government operated decontamination pad.

The contractor shall meet the following requirements for managing decon fluids.

1. At the end of each day, the contractor shall remove the decon fluids from the decon pad and place in steel drums. This drums will only contain decon fluids, and will not be mixed with IDW or any other material.
2. Drums containing decon fluids will be treated as satellite accumulation points until the drums are full or the drilling operation is complete, which ever comes first. These drums shall remain at the decon pad during drilling operations under the direct control of the drilling personnel at all times. When the drilling is complete at the end of the day, the drums will be secured.
3. Once the decon containers are full, or the drilling operation is over (which ever comes first), the drums will be moved to an accumulation site designated by the RPM. The drums will be labeled and treated as hazardous waste in accordance with the specifications listed in section 2.2.

2.7 PERSONAL PROTECTIVE EQUIPMENT AND SAMPLING EQUIPMENT

Disposable personal protective equipment (PPE) and sampling equipment shall be placed in separate 55-gallon drums supplied by Kelly AFB EM, which will be pre-labeled "**Hazardous Waste**". The RPM will make arrangements for the issuing of the drums to the contractor. The contractor shall be responsible for obtaining the empty, pre-labeled drums from Bldg. 317 on Kelly AFB and for delivering all full drums back to Bldg. 317. The contractor shall return all labeled drums to Bldg. 317 when full or within 60 days of issuance, which ever is less. The contractor shall notify the RPM when the drums have been returned to Bldg. 317. Environmental wastes, such as drill cuttings, purge water, development water, and general refuse such as empty bags, paper towels, and trash

shall not be placed in the issued drums. If an issued drum is not used within the allotted time, it shall be returned to the drum lot empty with the label still attached within 60 days of issuance. The contractor shall submit a written record on a weekly basis to the RPM during all field activities that generate PPE and disposable sampling equipment requiring the "**Hazardous Waste**" labels. The written record shall be a list of all label numbers issued, the date the labels were issued, the container contents, the date the container was filled, and the date the container was returned to Building 317. The contractor shall notify the RPM of the need for additional pre-labeled drums at least three working days before the drums are needed.

2.8 GENERAL REFUSE

The contractor shall be responsible for collecting and disposing of all general refuse that is not a hazardous waste, a class 1, 2 or 3 industrial waste or an environmental waste. General refuse shall include, but is not limited to, (1) empty paper sacks from filter pack sand, bentonite pellets, and cement, (2) plastic wrapping from well screens and well casings, (3) cut off pieces of well casing that have not been exposed to any potential contamination source, and (4) construction debris, such as asphalt, concrete, or wood scraps, and (5) food or drink containers and/or wrappings, or food. Work areas shall be left free of all debris before the end of each working day.

3.0 DOCUMENTATION

The contractor shall maintain the following logsheets as appropriate to document the construction of any well or soil boring installed: (1) soil boring log, (2) well completion log, (3) well development log, (4) pump test results, (5) well abandonment log, (6) a field notebook, (7) a photo log, (8) a well certification checklist and (9) a well abandonment certification checklist. Copies of these logs and notebooks shall be submitted to Kelly AFB. The contractor shall also maintain a groundwater sampling data log if the well is sampled.

3.1 SOIL BORING LOG

The contractor shall maintain a soil boring log for each soil boring or well installed. The log shall either be legibly printed or computer generated. If printed, the log shall be free of smudges, smears and stains that interfere with the legibility of the log. The log shall be completed using waterproof ink to ensure legibility if exposed to moisture. The soil boring log shall include, at a minimum, the following information:

General Information

1. Primary contractor name, logo, or letterhead
2. Soil boring or well number (use location identifier, not station number. See section 3.6.5).
3. Project name
4. Location
5. Northing coordinate
6. Easting coordinate
7. Surface elevation (soil borings only)
8. Drilling subcontractor
9. Drilling method and equipment
10. Drilling fluid used
11. Water levels
12. Date and time started
13. Date and time completed
14. Logger's name

Sample Information

1. Depth below surface (ft)
2. Sampling interval
3. Sample number
4. Sample recovery
5. Standard penetration test results
6. Soil description
7. Comments

The contractor shall denote any levels of organics detected by organic vapor analyzer (OVA), organic vapor meter (OVM), or other similar equipment in the comment section of the log. The contractor shall denote the ASTM soil classification of the sample in the soil description section of the log in addition to a full written description of the sample.

3.2 WELL COMPLETION LOG

The contractor shall maintain a well completion log for each well installed. The log shall either be legibly printed or computer generated. If printed, the log shall be free of smudges, smears, and stains that interfere with the legibility of the log. The log shall be completed using waterproof ink to ensure legibility if exposed to moisture. The well completion log shall include, at a minimum, the following information:

General Information

1. Primary contractor name, logo, or letterhead
2. Well number (use location identifier, not station number. See Section 3.6.5)
3. Project name
4. Intended use of well (sampling, recovery, etc.)
5. Location
6. Drilling subcontractor
7. Date and time started
8. Date and time completed
9. Logger's name

Well Information

1. Pad elevation
2. Measuring point elevation (bottom of notch in casing)
3. Borehole diameter
4. Casing diameter
5. Total depth of boring (below ground surface -bgs)
6. Depth at bottom of sump (bgs)
7. Depth at bottom of screen (bgs)
8. Depth at top of screen (bgs)
9. Depth at top of filter pack (bgs)
10. Depth at top of annular seal (bgs)
11. Depth at top of grout or slurry (bgs)
12. Casing material
13. Casing and screen joint type
14. Screen material (identify if machine slotted or wound wire)
15. Screen slot size
16. Filter pack mesh size
17. Filter pack volume (number of bags, buckets, etc.)
18. Filter pack placement method
19. Sealant materials
20. Sealant volume (number of bags, buckets, etc.)
21. Sealant placement method
22. Type of protective well cap
23. Comments

The log shall include a schematic illustration of the completed well. The depths required in items 6 through 11 of the well information shall be depicted on the illustration. The contractor is required to submit a State Well Report on forms supplied by the executive director of the TNRCC within 60 days of completion or cessation of drilling a well.

3.3 WELL DEVELOPMENT LOG

The contractor shall maintain a well development log for each well installed. The log shall either be legibly printed or computer generated. If printed, the log shall be free of smudges, smears, and stains that interfere with the legibility of the log. The log shall be completed using waterproof ink to ensure legibility if exposed to moisture. The well completion log shall include, at a minimum, the following information:

General Information

1. Primary contractor name, logo, or letterhead
2. Well number (use location identifier, not station number. See Section 3.6.5)
3. Project name
4. Location
5. Casing type and diameter
6. Screen interval (bgs)
7. Total depth (bgs)
8. Development
9. Logger's name

Development Information

The development information listed below shall be in a table form and shall be completed for each observance.

1. Date
2. Time
3. Water level
4. Gallons
5. pH
6. Specific conductivity
7. Temperature
8. Appearance

3.4 AQUIFER TEST LOGS

The contractor shall maintain all logs necessary to capture field data required to calculate hydraulic aquifer parameters derived from pump tests and/or slug tests, if such tests are performed. If the test data is recorded automatically, then the contractor shall submit a copy of the downloaded data to the RPM as directed.

3.5 WELL ABANDONMENT LOG

All information pertinent to well plugging shall be captured on a State of Texas Plugging Report form supplied by the Executive Director of the TNRCC. Information shall include as a minimum:

1. Time and date of abandonment
2. Personnel involved
3. Type of equipment used
4. Materials salvaged from the well
5. Amount of casing and well screen removed
6. Amount and type of materials used to seal the borehole

The plugging report must be submitted to the TNRCC within 30 days of abandonment.

3.6 FIELD LOGBOOK

All information pertinent to field activities shall be recorded in a bound logbook with consecutively numbered pages and shall be maintained by the field team leader. Entries in the field logbook shall be made in waterproof ink and shall include the following information:

1. Date and time of arrival at the work site
2. Personnel on site
3. Weather conditions
4. Field observations, maps, descriptions of site, etc.
5. Location, description, and sample collection methods
6. Field measurements such as pH, temperature, and conductance
7. Calibration records for any field analytical equipment
8. Photography log entries

3.7 PHOTOGRAPHS

The contractor shall take photographs to record field events. The photographs shall be taken with a 35mm camera equipped with a data logger that records the date and time the photograph was taken. The film shall be C135 color print film requiring C-41 processing, which is the standard 35mm color print film, and the ISO ("speed") of the film shall be compatible with the light conditions present at the time the photograph is taken. An ISO 200 (200-speed) film will be the most versatile film for field use. Photographs shall also be submitted digitally either on a diskette or a CD Rom. All photographs taken shall have photographic log entries made into the field log book, which shall include a roll identification number, the photograph number, the date and time photograph was taken, the subject of the photograph, and any pertinent information or comments such as direction the photographer was facing while taking the photograph. After the photographs are developed and printed, one set of the photographs will be mounted on 8.5-inch x 11-inch paper. The subject of the photograph and any remarks/comments shall be transferred from the photography log and shall be typed onto the paper below the photograph. Contractor may elect to print out digital pictures in color as opposed to mounting photographs on 8.5-inch x 11-inch paper. If this method is used, the contractor must again include the subject of the photograph and any remarks/comments from the photography log below the photograph. The roll identification number and photograph number shall also be included for future reference. Photographs to be taken shall include, at a minimum, the items identified in 3.7.1 through 3.7.3.

3.7.1 Soil Cores

The contractor shall photograph the cores removed from the boring after the boring is completed. All cores shall be placed together and each core shall be labeled as to the beginning and ending depths of the core. A sign shall be placed near the cores that shows the location identifier of the boring and shall be visible and readable in the photograph. The photograph shall be as near to a plan view as possible.

3.7.2 Well Pad

After the well pad has been completed, the contractor shall photograph the pad in such a manner to show a detailed view of the pad that shall include the pad, guardian posts

(if installed), and the brass plate. A sign shall be placed near the well pad that shows the location identifier of the boring and shall be visible and readable in the photograph. The photograph shall be as near to a plan view as possible.

3.7.3 General Location View

The contractor shall take a photograph or photographs of the surrounding area to aid in location of the well at a later time. The photograph(s) shall show the well pad or soil boring in relation to the surrounding area. The direction that the photographer is facing when the photograph is taken shall be annotated in the photography log section of the field logbook. A sign shall be placed near the well pad or soil boring that shows the location identifier of the boring and shall be visible and readable in the photograph.

3.8 WELL CERTIFICATION

All wells installed and all wells/soil borings abandoned in and around Kelly AFB are subject to the certification requirements of paragraphs 3.8.1 and 3.8.2 below. The certifications outlined below must be submitted to the RPM within 15 days of construction/abandonment.

3.8.1 Well Design and Construction Specification Checklist

Kelly AFB has developed a construction checklist to ensure the requirements for well installation, as specifically called for in the Kelly AFB Groundwater Compliance Plan, are followed. The checklist must be completed for each well or series of wells installed through projects related to Kelly AFB. The contractor may choose to address the checklist requirements through a workplan only if each section of the checklist is specifically addressed. A sample of this checklist is contained in Appendix B2.

3.8.2 Well and Soil Boring Abandonment Checklist

Kelly AFB has developed an abandonment checklist to ensure the requirements for abandonment, as specifically called for in the Kelly AFB Groundwater Compliance Plan, are followed. The checklist must be completed for each well or soil boring or series of wells or series of soil borings abandoned through Kelly AFB projects. The contractor may choose to address the checklist requirements through a workplan only if each section of the checklist is specifically addressed. A sample of this checklist is contained in Appendix B3.

This document *Installation and Closure of Shallow Aquifer Wells and Soil Borings on Kelly Air Force Base Technical Design Specifications, December 1998* supersedes the *Technical Specifications for Monitoring Wells, Sampling and Analysis, and Data Management* document issued in January 1994 and revised in April 1994.